PART 3

GENERAL REQUIREMENTS

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PART 3

GENERAL REQUIREMENTS

3.1 Introduction

This Part sets out the technical requirements that are general to the Contract.

3.2 Technical Standards and Regulations

Except where otherwise specified in the bid document plant materials and workmanship shall comply with the requirements of the relevant Indian Standards (hereinafter referred to as IS) issued by the Bureau of Indian Standards (BIS). Other equivalent National or International Standard Specifications such as those issued by the International Organisation for Standardisation (ISO) or the International Electro technical Commission (IEC) may be substituted by the Contractor (so as long as they are more stringent than the equivalent IS) at the sole discretion of the Engineer or as may have been agreed in the Contract. All standards used shall be the current and latest version.

The Electrical installation shall comply with all relevant statutory regulations and standards current at date of bids, unless otherwise indicated within the Employer's Requirements. Electrical installations shall, where relevant, be in accordance with the Indian Standards Code of Practice for Electrical Wiring Installations IS 732.

All materials, plant and equipment shall be new and all materials and workmanship not fully specified herein or covered by an approved standard shall be of such kind as is used in first class work and suitable to the climate in the project area.

Where reference is made in the Specification to a British Standard Specification (hereinafter abbreviated to `B.S.') issued by the British Standards Institution of 2, Park street, London W.I., or to an Indian Standard Specification (I.S.) issued by the Bureau of Indian Standards, (earlier known as Indian Standards Institution), Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi 110 002, or American Society for Testing and Materials (ASTM) issued by ASTM 1916 Race Street, Philadelphia, P.A., 19103, U.S.A. or American National Standards Institute (ANSI) issued by ANSI 1430, Broadway, New York, N.Y., 10018, U.S.A. or Japanese Industrial Standards (JIS) issued by Japanese Standards Association, 4-1-24, Akasaka, Minato-Ku, Tokyo 107, Japan or to any other equivalent Standard it shall be to the latest revision of that Standard at the Tender opening date.

The Contractor may propose, subject to employer approval and at no extra cost to the Employer, the use of any relevant authoritative internationally recognised Reference Standards, including Indian Standard (IS) and Japanese Industrial Standards (JIS), so long as they are at least as stringent as the equivalent IS if any.

All details, materials and equipment supplied and workmanship performed shall comply with these Standards. If the Bidder offers equipment to other Standards, the equipment/material should be equal or superior to those specified and shall be subject to approval by the Engineer and full details of the difference shall be supplied by the Contractor.

In the event of conflict between this Specification and the Codes for equipment, the most stringent provision shall govern, except as otherwise approved by the Employer. Certain specifications issued by national or other widely recognised bodies are referred to in this Specification. Such specifications shall be defined and referred to hereinafter as Standard Specifications. In referring to the Standard Specifications the following abbreviations are used:

IS : Indian Standard
ANSI : American National Standards Institute
API : American Petroleum Institute
ASME : American Society of Mechanical Engineers
ASTM : American Society of Testing and Materials
AWS : American Welding Society
AWWA: American Water Works Association
ISO : International Organisation for Standardisation
JIS : Japanese Industrial Standard
DIN : Deutsches Institute fur Normung
BS : British Standard
JWWA : Japanese Water Works Association
IEC : International Electrotechnical Commission
IEE : Institution of Electrical Engineers
IEEE : Institute of Electrical and Electronic Engineers
NEMA : National Electrical Manufacturers Association
AGMA : American Gear Manufacturer's Association

3.3 Precedence of Employer's Requirements

The requirements specified in the Particular Requirements parts, shall be in addition to those specified in the General Requirements parts. In case of conflict between the parts, the requirements of the Particular Requirements parts shall take precedence.

3.4 Units of Measurement

All designs, drawings, specifications and manuals shall use SI units and all measurements, dimensions and performance data shall be quoted in those units.

3.5 Programme

In accordance to Sub Clause 8.3 of the Particular Conditions of Contract, the Contractor shall submit within in the stipulated time detailed contract programme for approval, which shall include details of all temporary and permanent works, construction procedures and methodologies.

In addition to the requirements set down in the Conditions of Contract the programme shall include the following details:

(a) Contractor's organisational family tree for the Contract including details of all site supervisors and their responsibilities;

(b) A statement giving the numbers and categories of supervisory and technical staff and skilled and unskilled labour to be employed on the Works;

(c) A list and type details of major constructional plant (including vehicles) which the Contractor proposes to employ on the Works, including programmed dates for order and delivery;

(d) Details of the Contractor's methods of working for all operations;

(e) A statement giving the proposals for location or locations and sizes of offices, workshops and stores at the Site;

(f) A complete resource allocation showing the number of units and allotted times for each unit of constructional plant, materials and labour allocated to each part of the Works;

The programme shall be co-ordinated to take into account the requirements of climatic, groundwater and other conditions to provide for the completion of the Works in accordance with the Contract.

The programme shall be prepared using MS Project software and shall be submitted in both electronic softcopy and paper hardcopy form.

3.6 Contract Management

The Contractor shall be responsible for administration of the Contract from award of Contract through design, manufacture, manufacturer's works testing, and delivery of Plant to Site, installation, testing and performance testing to final take over. For this purpose he shall nominate a Contractor's Representative in accordance with Sub-clause 4.3 of the General Conditions of Contract who shall be fully responsible for and undertake this administration. The Contractors Representative shall be nominated exclusively for this project and should not be allocated or used for any other projects/works.

Specific responsibilities of the Contractor's Representative shall be:

(a) The sole representation on behalf of the Contractor in all discussion, correspondence and matters relating to the Works.

(b) The co-ordination and monitoring of Contract progress, which shall include the preparation of the Contract programme, monitoring of progress and submission of monthly progress reports. At the discretion of the Engineer, regular meetings shall be called at which the Contractor's Representative shall give a full account of the Contract progress and programme.

(c) The co-ordination and checking of designs, drawings and submissions. The Contractor's Representative shall be responsible for co-ordinating the design, technical information and data between sub-contractors. All calculations, drawings and information submitted to the Engineer shall be checked by the Contractor's Representative and certified as having been checked before submission.

(d) Contract communication between the Engineer and the Contractor. The Contractor's Representative shall attend all meetings involving the Contractor and the Engineer.

(e) The co-ordination and programming of manufacturer's works tests and the submission of test certificates.

(f) The co-ordination and programming of Plant delivery.

(g) The co-ordination and programming of the installation of Plant on the Site, site tests and take over trials. The Contractor's Representative, necessarily based at site, shall be responsible for the various sub-contractors. At the discretion of the Engineer regular site meetings will be held during which the Contractor's Representative shall give full account of site progress and programme.

(h) The Contractor's Representative shall also be responsible for producing in advance of the work being undertaken, detailed method statements of any work, which involves or affects the performance of existing equipment, processes, or disruption to existing water supplies.

(i) The co-ordination and preparation and submission of As-Built Drawings and Operation and Maintenance Manuals.

(j) Soft copies of all submissions should be in editable form.

(k) The preparation and co-ordination of training of Employer's Personnel.

(l) The submission of applications for payment.

3.7 Meetings

From time to time the Engineer will call meetings in the client office or at the Site, as he deems necessary, to discuss progress and any technical points requiring settlement.

The Contractor's Representative or responsible representative shall attend such meetings. The representatives from Contractor whose Curriculum vitae submitted and accepted by the Engineer vide Technical schedule – I during Technical bid evaluation or Equivalent engineers with the minimum qualification and experience mentioned in Technical schedule –I are only eligible to attend meetings.

The Contractor shall prepare and submit to the Engineer a daily activity report summarising the main activities undertaken each day.

3.8 Site Photographs

In accordance with the requirements of Clause 4.15 of the Conditions of Contract the Contractor shall supply negatives of photographs and unmounted positive colour prints not less than 250mm x 200mm of such portions of the Works, in progress and completed, as may be directed by the Engineer and specified herein. Contractor shall submit digital photographs in electronic format on any standard digital media such as USB hard drive of minimum capacity of 1 TB for every fortnightly. No prints of these soft copies shall be supplied to any other person without the written permission of the Engineer.

The photographs shall be of following categories:

- progress photographs
- record photographs
- Video (CD)

All categories of photographs shall be properly referenced to the approval of the Engineer, , an identifying description of the subject and the reference.

Photographs taken for record purposes as ordered by the Engineer or as specified herein shall be supplied with soft copy and three prints.

The taking of photographs of the Works by the Contractor for any other purpose whether for use in India or in any other country shall not be carried out without written approval from the Engineer.

The taking of photographs of the Works by the Contractor for any other purpose whether for use in India or in any other country shall not be carried out without written approval from the Engineer.

3.9 Setting Out of the Works

The contractor shall receive engineer's instructions for reference points and elevation points as benchmark.

The Contractor shall set out the Works, and carry out the Contractor's quality control procedures verifying the accuracy and precision of the setting out for each item of the works. The Contractor shall notify the Engineer sufficiently in advance of the setting out to enable the Engineer to observe the accuracy and precision of the laying out. The observations of the Engineer shall not relieve the Contractor of the responsibility under the Contract for the accuracy and precision of the setting out.

The Engineer shall approve dimensioned drawings, levels and other information necessary to enable the Contractor to set out the Works, at his own cost. The contractor shall provide all instruments such as theodolite, total station, leveling instruments in good working condition. The contractor shall also provide pegs, ranging rods, long measuring rods, marked meters and decimeters and each meter and decimeter numbered, posts and sight-rails, boning rods, moulds, template etc., together with any reasonable number of laborers that may be required and set out the Works and be responsible for the accuracy of the same. The Contractor shall amend at his own cost and to the satisfaction of the Engineer any error found at any stage which may arise through inaccurate setting out unless such error is based on incorrect data furnished in writing by the Engineer. The Contractor shall protect and preserve all control points and benchmarks used in setting out the Works till the end of the Defects Liability Period unless the Engineer directs its early removal. The Contractor should also keep the theodolite and levelling instruments in good working condition throughout the period of construction work on site.

The checking of any setting out or of any line or level by the Engineer shall not in any way relieve the Contractor of his responsibility for the correctness thereof.

No separate payment will be made for setting out the Works as required. Rates quoted by the Contractor for all items will be deemed to have covered the expenses for such setting out.

3.10 Details and Data made available by Employer

The Employer has the following data available and used these in formulation of the bid elements. They are listed below and shall be used only as guideline. The Employer does not, however, guarantee either the sufficiency or accuracy of the data provided. Contractor shall carry out fresh survey, investigation and particular testing/and all other details necessary for proper planning and detailed design. The Contractor will be required to provide full details of the investigations and analysis for approval of the Engineer.

- Site location
- Access Road

- Boundary
- The Employer has got the topographical surveys conducted and also established bench marks along the site. The contour map of site is available with BWSSB.

3.11 Engineers' office

A separate Portable containers office 2 numbers with minimum -3meters x12 meters for the sole use of the Engineer, his staff and Consultant shall be provided by the Contractor for this contract at STP site location identified by BWSSB. The proposed portable containers office shall be provided with provision of all necessary water supply, electrical arrangements, High speed broadband Internet connectivity. The contractor shall provide, erect, furnish, clean, maintain and subsequently the portable containers may be retained by the contractor for his use along with associated furniture/items after the completion of works. No Separate payment shall be made for these items. Portable Toilets with wash basin for gents and Ladies shall be provided with water and other facilities as required. The approximate sizes of Toilets, First Aid Room, UPS,Domestic ptable water are as follows:

i. Toilets with wash basin (Gents) - 2 No., 2m x 2.1m

ii. Toilets with wash basin (Ladies)- 2 No., 1.5m x 2.1m

iii. First Aid

iv. UPS for the complete 2 nos of portable containers office with alteast 60 mins backup on full load.

v. Domestic Potable water dispenser -as per requirement

The Contractor shall submit to the Engineer for his approval a drawing of the proposed Portable containers office with all details fully shown.

The Engineer's office should be ready in all respects within 30 days of handing over the site. Power, water supply and sewerage facilities shall be arranged by the Contractor.

The Contractor shall furnish the rooms as the Engineer directs and the equipment, furniture, furnishings and fittings to be supplied shall be of Godrej or Featherlite or approved make and include the following at each site.

(a) One conference table 10'- 0" x 5'- 0" with 12 chairs (approved make)

(b) 10 Nos. of 5' x 3' table with both side drawers (3 on each side)

(c) 4 nos. of 4' x 2 ½' table with drawers on both sides (3 on each side)

(d) 2 No. of 3' x 2' table with single side three drawers

(e) 20 Executive chairs (approved make) excluding chairs for Computer and Conference rooms

(f) 3 nos. chair (approved make) excluding for computer and conference rooms

(g) 4 Nos. of Steel cupboards (Storewel type)

(h) 1 no. Drawing cabinet

(i) 4 Nos. - 4 Drawers Filing Cabinet

(j) Filing cabinets, steel with locks and 4 drawers with suspended filing system

(k) Refrigerator (280 liters capacity) with double compartment of approved make.

(l) 4 nos. Fluorescent Desk lamp 20 watts

(m) 4 nos. Oscillating Desktop or wall mounted fan 400mm dia.

(n) Vertical blinds / Curtains to all windows

(o) Water supply/ plumbing/ electrical works complete

(p) Ergonomically designed Computer Table and Ergonomically designed Chair's – 5 nos.

(q) Broadband internet with required routers and cabling for the entire building with minimum 1 TB monthly plan with very high data speed. (minimum 200 mbps)

(r) Computer desktop system with 32" monitor (approved Make – refer approved makes under particular requirements Instrumentation & Automation) - 2 Nos. with following features:

- Intel Core (Latest processor system with latest windows professional)
- ATX Cabinet
- 256 KB external cache
- 32 GB RAM
- 1 TB HDD
- DRIVE DVD+RW
- 48X speed CD-ROM on EIDE controller
- 32" SVGA LCD flat panel color monitor
- 8 USB 2.0 ports, with at least 2 of these in the front
- Internet key board
- Optical Mouse and Mouse Pad (two sets)
- Pre-loaded with licensed Latest Windows Professional Operating System licensed MS Office with licensed antivirus software with license & firewall software, for the complete duration of the project. compatible with all Engineering Software's.
- All in one Colour LaserJet Printer (with Photocopier, Scan, Printer) suitable for A4/A3 size paper.

(s) All the necessary consumables including paper, CDs, printer cartridges etc.

(t) Wi-Fi Connection

(u) Fire Extinguisher – CO2 type (3 Kg) – 5 Nos

Electrical fittings shall include:

(a) 2 Nos of 4' 0" long tube lights (LED lighting fixtures) in each room except in Conference room and toilet.

(b) 2 Nos. of normal pendant bulbs in all rooms

(c) Air conditioner minimum 1.5 Tonnes for each room and 3 Nos of 1.5 Tonnes for conference room

(d) 1 Nos. 48" ceiling fan in each room and 4nos for conference room.

(e) All rooms shall have minimum 5 plug points including spare

(f) Exhaust fans 250 mm in all toilets

(g) Emergency lights

3.12 Engineer's Requirements

The Contractor shall provide the following for use by Engineer at the proposed STP plant site. These items are to be maintained by the Contractor in proper, safe, and clean working condition throughout the construction period.

No separate payment shall be made for the items covered here.

3.12.1 Vehicles

The Contractor shall purchase and maintain two vehicles - one new Toyota Innova Crysta A/C (High End model Vehicle) and one new Tata Nexon EV/Equivalent vehicle's for the contract to be kept available at all times for the sole use of the Engineer and his staff at the cost of contractor. The Contractor shall be solely responsible for the upkeep of the vehicle including taxes, insurance, licenses, fuel, oils, lubricants, repairs, and maintenance and shall also provide a competent driver along with the vehicle and driver shall be familiar with Kannada and English Languages. At the end of works contract the Contractor shall transfer the vehicles in good condition to Employer. No extra payment shall be made on this account and shall be deemed to be included in the quoted price.

Testing of Materials

The Contractor shall provide a laboratory at a suitable location as approved by Employer for the testing of materials.

The laboratory shall have the following facilities required for sampling and testing materials and concrete in the field. All such facilities shall be provided by the Contractor at no extra cost to the Employer. The following equipment with operators shall be made available at Employer's request (all must be in serviceable condition):

1.	Concrete cube testing machine suitable for 15 cm cubes of 100 tonnes capacity with proving calibration ring	1 No.
2.	Cast Iron Cube moulds 15 cm size	24Nos. (Minimum)

3.	Slump cone complete with tamping rod (as required to suit (concrete plan)	1 set
4.	Laboratory balance to weigh upto 5 Kg. with sensitivity of 10 gm.	1 No.
5.	1 S. Sieves for coarse and fine aggregates	1 Set
6.	Set of measures from 5 liters to 0.1 liter	1 Set
7.	Electric oven with thermostat upto 120^{o}C	1 No.
8.	Flakiness gauge	1 No.
9.	Schmidt Hammer	2 Nos.
10.	Elongation index gauge	1 No.
11.	Sedimentation pipette	1 No.
12.	Pycnometer	1 No.
13.	Calibrated glass jar (1 litre capacity)	2 Nos.
14.	Glass flasks and metal containers	As required
15.	Chemical reagents like sodium hydroxide, tannic acid, litmus papers, etc.	As required
16.	Laboratory balance of 2 Kg capacity and sensitivity of 1 gm	1 No.

Note: Arrangement can be made by the Contractor to have the cubes tested in an approved laboratory in lieu of a testing machine at site at his expense, with the prior consent of the Employer till the laboratory is fully established. The Laboratory fully equipped shall be setup within 6 months after Notice to proceed with the work is issued.

The outside laboratory shall also be used for routine testing of cement, reinforcement and other items with the approval of Engineer.

3.12.2 Electrical Systems

1. Lighting Distribution Board

1.1 The Distribution Board shall be of high quality CRCA sheet steel enclosed with IP 54 protection, suitable for surface mounting on the wall. Premier quality powder coating shall be applied and the final shade shall be Light Grey Semi Glossy Shade 631 of IS 5.

1.2 The Distribution Board shall be provided with double door arrangement single front consisting of an intermediate plate with necessary windows and a door so that when the door is opened, live parts are not exposed. Pad locking shall be provided.

1.3 The Distribution Board shall be provided with removable top and bottom gland plates with adequate number of knockouts to enable top and bottom entry of conduits and cables.

1.4 The Distribution Board shall be of phase segregated type and copper bus bar to be provided.

1.5 The incomer shall be TPN, MCCB of required rating. The sub incomers for each phase shall be DP, MCB's of required rating. The outgoings shall be SP MCB's of required ratings along with ELCB.

1.6 Two earthing terminals shall be provided to suit the earthing conductor

2. Luminaries

2.1 The luminaries (LED) for all office premises shall have the following features:

- The Housing made of epoxy powder coated extruded aluminium / CRCA sheet suitable for suspended /surface mounting/recess mounting.
- Decorative low glare mirror optics with anodised aluminium louvers.
- Designed for 2x 36 W TL-D LED lamps.
- Number of luminaries for each room shall be selected to achieve illumination level of 300 lux.
- In addition to the above luminaries, down light with the following features shall be provided at the four corners of the conference room.

  (i) Housing made of Powder Coated CRCA, Sheet steel, suitable for recess mounting with wide cast aluminium ring.

  (ii) Anodised aluminium reflector for low glare and diffused lighting.

  (iii) Suitable for horizontally mounted Single 18W LED lighting.

2.2 The luminaries for other rooms &toilets shall have the following features:

- Housing made of Powder Coated CRCA Sheet steel, suitable for surface mounting on ceiling /wall.
- Cover made of Opal acrylic.
- Designed for 1x 36 W, TL'D'LED lamps.

3. Ceiling Fans

The Ceiling Fan shall be of 48" size, 3 blades type. The fan shall be with aerodynamically balanced aluminium blades. The fan shall be provided with double ball bearings precisely aligned for noiseless performance. The fan shall be powder coated and complete with all mounting accessories. The fan shall be suitable for operation with electronic fan regulator. One Ceiling fan shall be provided for each 10 m^2 or part thereof of the area concerned.

4. Switchboards

The Switchboard shall have unbreakable concealed box and mounting plate flushed with wall. The mounting plate shall be of twin plate arrangement, inner plate to hold the modules and the outer cover plate. The switch board shall have required Nos. of switches for lighting fixtures& Ceiling fans. The switches shall be of modular type with minimum rating of 6 amperes. Each lighting fixture& Ceiling fan shall be provided with individual switch. The switchboard shall be provided with one no. 6 Amperes 5 pin universal socket with switch. Number of modules in the switchboard shall be to suit the actual requirement. Atleast 2 Nos. 6 A switches shall be provided in each switchboard as spares. The cover plate and switches shall be of white /cream in color. Minimum One no. of Switchboard shall be provided in each of the premises.

5. Switch Sockets

The switch sockets shall have unbreakable concealed boxes and mounting plates flushed with the wall. The mounting plates shall be of twin plate arrangement, inner plate to hold the modules and the outer cover plate. Each switch socket shall be provided with 15 Amps, 240 V, Switch and 6 Pin socket. The number of switch sockets shall be 5 Nos. in each of the premises and one no. in Pantry.

6. Power Plug & Sockets

The power sockets shall have unbreakable concealed boxes and mounting plates flushed with the wall. The mounting plates shall be of twin plate arrangement, inner plate to hold the modules and the outer cover plate. Each power socket shall be provided with 16 Amps, 240 V, SPN MCB and 16 Amps, 240 V, 3 Pin socket and 16A 3 Pin Plug. The number of Power Plug & sockets shall be provided as per requirement in various premises & pantry.

7. Peripheral Lighting

Bracket/Conduit mounted Peripheral Lighting shall be provided on all the corners of the building.

The Lighting fixture shall have the following features

- Weather Proof Housing made of Powder Coated CRCA Sheet steel.
- Cover made of Opal acrylic.
- Designed for 1x 36 W, TL'D' LED lamps.

The Contractor shall arrange for a telephone line at proposed STP site covered under the contract for sole use by Engineer. The Contractor shall pay for the installation charges. A separate provisional sum is allotted for the payment of calls made by the Engineer. The Contractor shall transfer the telephone instrument and its ownership to the Employer after completion of works.

Contractor to display the STP Physical model with minimum plan dimension of 3.0m x 3.0m and a 3-D animation video of the entire plant, processes and process flow. The model and animation shall

include all buildings and structures in the entire Doddabele STP campus (including existing facilities). The model shall be enclosed in a transparent cabinet with scratch resistant surface. The model and animation shall be constructed to the highest quality showing all visible details, including plant items, architectural finishes, hard and soft landscaping, roads, street lightning, fences and all other such detailed items. The 3-D animation shall be displayed on 62" LED screen to be displayed in the main entrance lobby of the admin building. The entire model and animation system shall be maintained by the contractor throughout the contact period, which shall include the operation & maintenance period

3.12.3 Assistance to the Engineer

The Contractor shall provide all necessary assistance to the Engineer and his staff in carrying out their duties of checking, inspecting, and measuring the Works. The Contractor shall provide, at no additional cost, chainmen, staff men, office attendants, and labourers as may be needed from time to time by the Engineer.

The Contractor shall provide for the Engineer and his staff, consultants and their staff and visitors such protective clothing, safety helmets and rubber boots of suitable sizes, hand lamps and the like as may be reasonably required by them. These articles shall remain the property of the Contractor. No extra payment shall be made on this account.

3.12.4 Instruments to be Provided

The Contractor shall provide at his own cost for the exclusive use of the staff of the Engineer all brand-new survey equipment and measuring instruments of approved make and of every kind necessary for the execution of the Works, including

(a) Battery operated latest automatic total station with full setup and software/ One 360-degree circle optic theodolite, accurate to one second, complete with carrying case and sliding leg tripod with operator shall be in use of client for the entire construction period. Same shall be handed over to BWSSB in good working condition with valid calibration certificate after completion of construction.

(b) Two auto levels with horizontal 360 degrees circle, tripods with carrying case.

(c) Two staffs, 4.5 m long, each in 3 sections and with attached bubbles, graduated in metres and tenth and hundredths of a metre.

(d) Two Surveyor's steel bands of which one shall be 100 m long and approximately 20 mm wide and one shall be at least 30 m long and approximately 12 mm wide, each fully divided, complete with tape thermometers and tension handles and wound on an open plastic cross.

(e) An adequate number of ranging rods, steel and linen tapes, string lines, pegs, lines, spirit levels, survey umbrellas, lights, batteries, stores and tools.

The instruments mentioned above shall be for exclusive use of the Engineer and shall remain in the custody of the Engineer till the Works are completed.

The Contractor shall be solely responsible for all such instruments and equipment and shall ensure that they are at all times in good repair and adjustment, and shall make good any loss or damage howsoever caused. No extra payment shall be made on this account.

On completion of the Works, the entire set of instruments provided by the Contractor shall be the property of the Employer.

3.13 Erection of Plant

Erection of Plant shall be phased in such a manner as not to obstruct the work being done by other contractors.

Before commencing any erection work, the Contractor shall check the dimensions of structures where the various items of Plant are to be installed and shall bring any deviations from the required positions, lines or dimensions to the notice of the Engineer.

Plant shall be erected in a neat and workmanlike manner on the foundations and at the locations shown on the Approved Drawings. Unless otherwise directed by the Engineer, the Contractor shall adhere strictly to the aforesaid drawings.

The Contractor shall be responsible for setting up and erecting the Plant to the line and level required and shall ensure that all Plant is securely held and remains in correct alignment before, during and after grouting-in. This responsibility shall not be passed to any other contractor.

Any damage caused by the Contractor during the course of erection to new or existing plant or building or any part thereto, the Contractor shall at his own cost, make good, repair or replace the damage, promptly and effectively as approved by the Engineer and to the Engineer's satisfaction.

3.14 Site Labour and Supervision

The Contractor shall provide all the skilled and unskilled labour required, and all necessary tools and equipment, to erect, test and commission the Works within the period agreed in the programme.

The Contractor shall not remove any supervisory staff or skilled labour from the Site without the Engineer's prior approval.

3.15 Sub-letting

The Contractor shall not sub-let the whole of the Works. Where any design or manufacture is sub-let, the Contractor shall not be relieved of his obligation under the Contract. The Contractor shall be responsible for the acts, defaults and neglect acts in manufacture or design of any Sub-Contractor, as if they were his own.

Where the Engineer has consented to supply of Plant or execution of work by manufacturers or sub-contractors proposed by the Contractor, such manufacturers or sub-contractors shall not be changed without the prior approval in writing of the Engineer.

A copy of every sub-order shall be sent to the Engineer at the time the order is placed each clearly marked with the title of the Contract and the Contract number.

3.16 Temporary Works

Not less than 14 days before commencing any portion of the Works, the Contractor shall submit to the Engineer for his approval comprehensive drawings and calculations for all Temporary Works which the Contractor proposes for the construction of that part of the Works.

Notwithstanding approval by the Engineer of any design for the Temporary Works, the Contractor shall be entirely responsible for their safety, efficiency, security and maintenance and for all obligations and risks in regard to such Temporary Works specified or implied in the Contract.

3.17 Languages

All drawings, instructions, signs, notices, name-plates, etc. for use in the design, construction, operation and maintenance of the Works shall be in English.

All site sign boards and warning signs shall be in Kannada, Hindi and English Languages.

3.18 Drawings and Information to be Provided

3.18.1 General

The drawings that will be prepared and issued for this Contract shall be classified as follows and where relevant shall be to a scale which is suitable for the representation of those details illustrated.

The term Drawing shall be deemed to include all drawings, schedules, lists, software documentation, descriptive text and calculations necessary for the design, construction, operation and maintenance of the Works and referred to in this clause.

Drawings and all other submittals required during bidding stage and after award of Contract shall be submitted in editable electronic softcopy format on USB Hard Disk of 2 TMB capacity as well as in hardcopy paper format. The Contractor shall submit plan and levels of the STP in soft copies and five hard copies to the client for approval.

The softcopy format for various items shall be as follows:

- Drawings: AutoCAD version Latest version
- Text Documents: Microsoft Word latest version and above including Microsoft Project
- Spreadsheets, Hydraulic design/capacity/power calculations, tables, technical schedules, prices schedules, and other numerical data: Microsoft Excel New version and above
- All other required information not included in the above: Adobe Portable Document Format (PDF) latest version

The hardcopy format/sizes for various items shall be as follows:

- Drawings: Standard A1 size paper. The scale for each drawing shall be selected such that the information is presented without any clutter or ambiguity and is clearly and easily legible without the use of magnifying aids other than a reader's normal eye-glasses.
- All other information: Standard A4 or A3 paper size, except for any pre-printed standard information such as brochures or catalogue information, which may be submitted in the original size and format.

3.18.2 Drawing Format and Numbering

All drawings shall be prepared using an identical title block format. This shall be approved by the Engineer and shall identify the project, drawing title, the Engineer, the consultants, the Contractor, Sub-contractor, if applicable, and the Engineer.

A formalised drawing numbering system shall be adopted with digits of each number, referencing location, revision, drawing type and size. The numbering format and allocation of drawing number blocks shall be approved by the Engineer.

The Contractor shall provide a sequential numbering system for all Construction Documents. The drawing number shall not be repeated or duplicated.

All drawings shall be submitted to a formalised checking procedure prior to submission. Drawings not so checked will not be approved.

3.18.3 Pre-contract Drawings

The Pre-contract Drawings are those issued to Bidders either with the Bidding Documents for the purpose of illustrating and clarifying the Works described in the Employer's Requirements or later during the bidding period as part of an Addendum to the Contract Documents.

Such drawings shall be deemed to have been issued for the guidance of Bidders and shall, for the purpose of executing the Works, be superseded by the Construction Documents.

3.18.4 Bid Drawings and Details

The Bid Drawings are those furnished by a Bidder with his Bid for the purpose of illustrating and clarifying his proposals and for being technically qualified.

The following drawings, details and specific information pertaining to the entire sewage treatment process / plant shall be furnished by the Bidder for STP in the technical envelope in addition to other information required as mentioned elsewhere in the tender.

The lists provided below shall not be considered comprehensive. The bidder shall be responsible for including any and all drawings and information for any and all works that may be necessary for full and complete definition or clarification of the design, regardless of whether or not such drawings, information, or works are explicitly included in the lists below or elsewhere in these bid documents.

The bid drawings and other technical documents shall be submitted in soft copy format on CD/Hard disk as well as in hardcopy paper format.

(a) General, Process, Electrical and ICA

(i) Narrative Description of the Works.

(ii) Plant Operation and Control Philosophy with complete automation as proposed.

(iii) Sizing and Design Calculations covering all Unit Processes and components of the Works.

(iv) Plant Layout with list of all structures (basins, tanks, channels, buildings, pipeline etc.) including dimensions and freeboards.

(v) Complete Equipment List.

(vi) Hydraulic Profile.

(vii) Process Flow Diagram.

(viii) Process and Instrumentation Diagrams (P&IDs) in line with bid requirements

(ix) Bidder proposed system configuration diagram

(x) Other requirements/documentation as required under Instrumentation & control requirements for technical qualification

(xi) Electrical Load List & Power Consumption Chart.

(xii) List of Chemical Consumption on Daily/ Monthly Basis.

(b) Mechanical

(i) To-scale dimensional mechanical general arrangement drawings, layout and/or installation drawings for the following Equipment, at a minimum:

- Primary treatment system
- Secondary treatment system
- Submersible Mixers for Bioreactor (Aerobic, Anoxic and deaeration zones)
- Chlorination system

(ii) Graphs for all major pumps and blowers (including but not limited to Primary Sludge Pumps, Primary scum pumps, Return Activated Sludge Pumps, Waste Activated Sludge pumps, Mixed Liquor Recycle Pumps, Process Air Blowers, Secondary Scum pumps, Secondary Sludge pumps, Plant water pumps, plant drain pumps, Bore well water pumps, alum dosing pumps, Booster pumps, Filter Backwash Pumps):

- Pump Performance Curves: Q vs H, speed, P, Efficiency, and NPSH
- ISO-efficiency curves of the pump model proposed

(c) Efficiency curves of the pump model proposed

(i) Electrical Single Line Diagram of STP and PS

(ii) Sizing Calculations for Transformers and DG Set of STP and PS

(iii) Electrical Load List & Power Consumption chart with Specific Energy Consumption.

(iv) Construction schedule.

(d) Technical schedules for all equipment to be completely filled and with supporting documentation

(i) Completely filled technical schedule for Mechanical equipment

(ii) Completely filled technical schedule for Electrical equipment

(iii) Completely filled technical schedule for Instrumentation, Control & Automation equipment

3.18.5 Drawings and Calculations to be submitted by the Contractor for Approval

Drawings / Calculations for approval shall be submitted by the selected Contractor after award of the contract in two Stages.

The first phase shall be the Preliminary Drawings / Designs. Drawings / Designs submitted during this phase shall be of sufficient detail for the Engineer to understand in outline the Contractor's proposals for the design and construction of the Works. The lists provided below shall not be considered comprehensive. The bidder shall be responsible for including any and all drawings and information for any and all works that may be necessary for full and complete definition or clarification of the design, regardless of whether or not such drawings, information, or works are explicitly included in the lists below or elsewhere in these bid documents.

The Preliminary Drawings / Designs for STP with associated PS and pumping main shall inter alia comprise:

- Detailed Description of the proposed Sewage Treatment Plant and Treatment Process offered (including Raw and Treated Sewage Quality).
- Entire process designs calculations and dynamic modelling of proposed plant shall be carried out using *BioWIN* software. All inputs and outputs files shall be provided for review and approval with Basic Engineering Package for approval before commencement of construction works.
- Technology description and technical details of **Primary Clarification followed by Activated Sludge treatment with Biological Nutrient Removal (Nitrification, De-nitrification, and Phosphorus Removal), with Tertiary Treatment, and Chlorine Disinfection (MLE Process), Temperature phased Anaerobic Digestion, with on-site Power Generation and sludge Dewatering**treatment process.
- Detailed Plant Operation and Control Philosophy.
- Detailed Process Design Calculations / Mass Balance Calculations covering all Units/ Equipment.
- Detailed List of Units including Unit Dimensions/ Free Boards.
- Detailed Equipment List.
- Piping Schedule to include size, material, coating, lining, gauges/thickness, and pressure rating.

- Valve Schedule to include size, type, material, pressure rating, operator/actuator type, and whether Open/Close or Modulating.
- Gate Schedule to include size, type, differential head, seating or unseating, operator/actuator type, and whether Open/Close or Modulating.
- Detailed Plant Layout (including Pipe Sizes/ Pipe Routing/ Channel Size/ Channel Routing/ Site Roads/ Site Drainage/each processing facilities).
- Detailed Hydraulic Profile including Hydraulic Calculations.
- Process and Instrumentation Diagram (P&ID)
- Instrumentation, Control & Automation details as required under Bid requirements.
- Detailed Chemical Consumption Calculations (Daily/ Monthly Basis).
- Transformer sizing calculation for STP and PS based on approved Electrical load list.
- D.G sizing calculation for STP and PS based on approved Electrical load list.
- Full Hazardous Area Classification Analysis and Report per IS 5572 for STP and PS in the contract.
- Hazardous Area Classification Drawings per IS 5572 for STP and PS in the contract.
- Design Concept Report for Electrical Equipment includes total power consumption.
- HAZOP study documentation and its compliance.

The second stage shall be the Detailed Engineering Design phase and shall comprise the submission of the Detailed Mechanical/ Electrical/ Instrumentation, control and automation/ Structural/ Civil Construction Drawings and Calculations and Civil guideline drawings. These shall be submitted after the approval of the Preliminary Drawings in the sequence namely, Mechanical General Arrangement drawings shall be submitted only after approval of Basic Engineering Package (BEP's) - Design drawing documents. Civil drawings shall be submitted only after obtaining approval to Mechanical General Arrangement drawings in B- code.

Mechanical Equipment data sheet submissions shall be made only after obtaining approval to Basic Engineering Package (BEP's) Design- Drawings and relevant Mechanical General Arrangement drawings.

All relevant detailed structural designs and detailed engineering drawings shall be prepared in compliance with the approved Civil GA guideline drawings from all related disciplines (i.e. Process, Mechanical, Electrical, Instrumentation etc.., whenever applicable) for all related structural components as required.

The lists provided below shall not be considered comprehensive. The bidder shall be responsible for including any and all drawings and information for any and all works that may be necessary for full and complete definition or clarification of the design, regardless of whether or not such drawings, information, or works are explicitly included in the lists below or elsewhere in these bid documents.

The Construction Documents shall be used for the construction of the Works and shall inter alia comprise:

(a) Civil

Site layouts for STP and PS providing information on levels and detailing the location of:

- Detailed List of Units including Unit Dimensions/ Free Boards.
- General arrangements and main sections of all plant areas.
- Plans, elevations and main sections of all structures and buildings.
- Buildings.
- Storage tanks.
- Process plants.
- Transformer enclosures.
- Roadways.
- Drainage (plant drainage, sanitation and storm water drainage).
- Buried pipelines.
- Cable routes for direct in ground and ducted systems.

Detail drawings of:

- Cable and pipework chambers.
- Buried pipework.
- Pipework connections.
- Contract interface.
- Reinforcement drawings.
- Bar bending schedules.

Calculations for:

- Detailed Structural Design calculation of all the units/ Structures; (all civil structure design and analysis shall be carried out in *STAAD Pro* software). All inputs and output files shall be provided for review and approval.

(b) Hydraulic

- Detailed hydraulic profile (PS, STP & discharge pipe).
- Detailed hydraulic calculations (PS, STP & discharge pipe).
- Plan and L-Section profile of Pumping Main.

(c) Process and Mechanical

Drawings:

- Process flow diagram.
- Comprehensive P&ID s including details of.

Calculations for:

- Detailed Process Design Calculations / Mass Balance Calculations covering all Units/ Equipment.
- Detailed List of Units including Unit Dimensions/ Free Boards.
- Detailed Process Flow Diagram (inclusive of Mass Balance).
- Detailed Equipment List.
- Detailed Electrical Power Consumption Calculations.
- Detailed Chemical Consumption Calculations (Daily/ Monthly Basis).

(d) Mechanical

Drawings:

- Major Equipment /Instrument Specifications (with supporting Brochures).
- Major Piping Schedule to include size, material, coating, lining, gauges/thickness, and pressure rating.
- Major Valve Schedule to include size, type, material, pressure rating, operator/actuator type, and whether Open/Close or Modulating.
- Gate Schedule to include size, type, differential head, seating or unseating, operator/actuator type, and whether Open/Close or Modulating.

(e) Instrumentation, Control and Automation

- Instrumentation Functional Design specifications
- Control & Automation Functional design specifications.

Mechanical General Arrangement drawings shall be submitted only after approval of Basic Engineering Package (BEP's) Design drawing documents.

Civil drawings shall be submitted only after obtaining approval to Mechanical General Arrangement drawings in B- code.

Equipment data sheet submissions shall be made only after obtaining approval to Basic Engineering Package (BEP's) Design- Drawings and relevant mechanical GA drawing.

Outline dimensional drawing & Cross section Drawing (with Bill of Quantity and Material of construction) for the following items for PS, STP and but not limited to:

1.	Sluice valve – motorised
2.	Sluice valve – manually operated
3.	Non-Return valves
4.	Knife Gate Valves
5.	Air release valves

6.	Butterfly valves – manual and motorized
7.	Gate valves - motorized
8.	Dismantling joints
9.	H.O.T & E.O.T Cranes
10.	Sluice gate – Manual & Motorised
11.	Dewatering Pumpset
12.	Scum removal system – primary and secondary
13.	Primary Sludge Pumps
14.	Primary Scum Pumps
15.	Mixers for Primary and Secondary Sludge Sump
16.	Process Air Blowers
17.	Return activated sludge Pumpset
18.	Waste Activated Sludge Pumpset
19.	Submersible Mixers for Anoxic zones
20.	Chlorination system
21.	Mixed Liquor Internal Recycle Pumps
22.	Alum dosing system
23.	Secondary Sludge Pumps
24.	Secondary Scum Pumps
25.	Disc filter
26.	Plant Drain Pumps
27.	Plant Water Pumps, other equipment.
28.	Longitudinal sections for Raising main and cross section details.

Graphs for all major pumps and blowers (including but not limited to, Primary and secondary Sludge Pumps, Return Activated Sludge Pumps, Waste activated sludge pumps, Mixed Liquor Recycle Pumps, Process Air Blowers, alum dosing pumps):

Pump Performance Curves: Q vs H, speed, P, Efficiency, and NPSH

Efficiency curves of the pump model proposed, Motor Curve

Graphs for all major pumps and blowers (including but not limited to, Primary and secondary Sludge Pumps, Return Activated Sludge Pumps, Waste activated sludge pumps, Mixed Liquor Recycle Pumps, Process Air Blowers, alum dosing pumps):

Pump Performance Curves: Q vs H, speed, P, Efficiency, and NPSH

Efficiency curves of the pump model proposed, Motor Curve

(f) Electrical

Drawings and calculations:

(1) Detailed Electrical Load List with operating hours for PS and STP prepared based on approved Equipment list from process and Mechanical.

(2) Transformer sizing calculation for PS and STP based on approved Electrical load list.

(3) D.G sizing calculation for PS and STP based on approved Electrical load list.

(4) Single Line Diagram of Complete Electrical System for PS, STP based on the equipment finalized by Mechanical and Process.

(5) Electrical Substation Layout of PS and STP showing Panel locations, Transformer locations and Trench Layout.

(6) 11kV Switchgears:

(a) Guaranteed Technical Particulars.

(b) Dimensional Drawing showing overall dimensions, plan, elevation and cable entry details.

(c) Complete assembly drawings of the Switchgear showing plan, elevation and typical sectional views, details of bus bars and location of cable end boxes and control cable terminal blocks for external wiring connections, etc.

(d) Foundation plan showing the location of channel sills, anchor bolts and anchors, floor plans and openings.

(e) Single Line Diagram, Schematic power and control wiring diagrams along with control & interlock details, complete bill of materials indicating make, type, rating, setting etc. of Circuit breakers, relays, contactors, current transformers, potential transformers, instruments, meters, annunciations etc.

(7) 3.3kV or 6.6kV Switchgears

(a) Guaranteed Technical Particulars.

(b) Dimensional Drawing showing overall dimensions, plan, elevation and cable entry details.

(c) Complete assembly drawings of the Switchgear showing plan, elevation and typical sectional views, details of bus-bars and location of cable end boxes and control cable terminal blocks for external wiring connections, etc.

(d) Foundation plan showing the location of channel sills, anchor bolts and anchors, floor plans and openings.

(e) Single Line Diagram, Schematic power and control wiring diagrams along with control & interlock details, complete bill of materials indicating make, type, rating, setting etc of Circuit breakers, relays, contactors, current transformers, potential transformers, instruments, meters, annunciations etc.

(8) Diesel Generator Set

(a) Guaranteed Technical Particulars.

(b) GA Drawing showing overall dimensions, plan, elevation, sectional views, mounting arrangement, layout, make, type, rating etc. of diesel engine, Alternator, Control panel, battery, battery charger etc.

(c) Single Line & Schematic diagrams showing details of Power & Control, change over, AMF details, Synchronising details, interlocks, protections, annunciations, battery, battery charger etc. with make, type, rating, setting etc. of various equipment, components etc.

(d) Foundation plan showing the location of channel sills, foundation, anchor bolts and anchors, floor plans and openings.

(e) Exhaust system with piping layout.

(f) Day oil tank sizing with mounting arrangement details.

(g) Fuel bulk storage tank sizing with mounting arrangement details

(h) Fuel supply system with pipe arrangement

(9) 11kV / 3.3 kV or 11/6.6kV Transformers

(a) Guaranteed Technical Particulars.

(b) General arrangement drawing of the transformer, showing plan, front elevation and side elevation complete with all accessories and fittings, detailed dimensions, net weights, quantity of oil, clearances between HV terminals, between LV terminals, between HV and LV terminals, between HV & LV terminals and ground etc.

(c) Rating, diagram and terminal marking, complete with polarity and vector group.

(d) Control wiring diagram for marshalling box.

(e) Foundation drawing with position of foundation bolts and depth.

(10) 11kV / 0.433 kV, 2500KVA Transformers

(a) Guaranteed Technical Particulars.

(b) General arrangement drawing of the transformer, showing plan, front elevation and side elevation complete with all accessories and fittings, detailed dimensions, net weights, quantity of oil, clearances between HV terminals, between LV terminals, between HV and LV terminals, between HV & LV terminals and ground etc.

(c) Rating, diagram and terminal marking, complete with polarity and vector group.

(d) Control wiring diagram for marshalling box.

(e) Foundation drawing with position of foundation bolts and depth.

(11) L.T Panels, Distribution Boards, Power Control Centres, Power Motor Control Centres, Motor Control Centres etc.

(a) Guaranteed Technical Particulars.

(b) Dimensional Drawing showing overall dimensions, plan, elevation and cable entry details.

(c) Complete assembly drawings of the switchboard/distribution board / MCC showing plan, elevation and typical sectional, views, details of bus-bars and location of power & control cable terminal blocks for external wiring connections, etc.

(d) Foundation plan showing the location of channel sills, anchor bolts and anchors, floor plans and openings.

(e) Single Line Diagram & Schematic power and control wiring diagrams along details, complete bill of materials indicating make, type, rating, setting etc. of Circuit breakers, relays, contactors, current transformers, potential transformers, instruments, meters, annunciations etc.

(f) Feeder Operation and Interlock logic.

(12) H.T & L.T Capacitor bank with Automatic Power Factor Correction Relay

(a) Guaranteed Technical Particulars.

(b) Fully dimensioned general arrangement drawings of capacitor and capacitor control panel with elevation, side view, sectional view and foundation details.

(c) Justification for number of steps for switching.

(d) Single Line Diagram, Schematic and wiring diagrams for capacitor control panel complete with bill of materials.

(13) Variable Frequency Drives

(a) Guaranteed Technical Particulars.

(b) Dimensional details with mounting arrangement.

(c) Single Line Diagram & Schematic power and control wiring diagrams along details, complete bill of materials indicating make, type, rating, setting etc. of various equipment/ components/ items.

(d) Specific details of converter, inverter and harmonic control units.

(14) Battery and Battery Charger with D.C. Distribution board

(a) Guaranteed Technical Particulars.

(b) Dimensioned general arrangement drawings.

(c) Fully dimensioned general arrangement drawings of battery and battery charger with elevation, side view, sectional view and foundation details.

(d) Complete schematic and wiring diagrams with bill of materials.

(15) Non Segregated LT Bus duct

(a) Guaranteed Technical Particulars.

(b) Dimensioned general arrangement drawings.

(c) Layout drawings with bill of materials.

(16) Cabling System

(a) Guaranteed Technical Particulars of HT & LT Power and Control Cables.

(b) Details of Installation of Cables in Trenches, on cable trays, directly buried etc. at all locations inside the plant.

(c) Cable routing plan and section inside the plant.

(d) 11kV Cable termination and mounting Kit Layout drawing.

(e) Datasheets for various cables.

(17) Lighting system

(a) Make, type, rating etc. of various fixtures, receptacles, switches etc. in various premises.

(b) Make, type, rating etc. of various fixtures, lighting poles etc. for street lighting and flood lighting.

(c) Detailed Room wise Lighting Layout with Type of fixture details and Circuit diagram showing phase wise load distribution and interconnection between switches, fixtures, Lighting panel, receptacles etc.

(d) Internal road Lighting and Area lighting layout with location of poles, details of fixtures and mounting.

(e) Street Light pole details with Foundation details.

(18) Earthing System and lightening Protection

(a) Details such as material, sizes, etc. of the earth conductor and electrode pits.

(b) Earthing layout drawing showing routing of main grid inside the plant with details of interconnection of equipment earthing to the grid and earth pits.

(c) Lightening Protection Layout showing the formation of lightening mesh/grid on roof top, routing of down conductors, connection with the earth pit.

(d) Details of Lightening protection system comprising of air termination, down conductors, test links, earth pits etc.

(19) Electrical Equipment and Panel Layout for PS and STP.

(20) Indoor & Outdoor Lighting Layout for PS and STP.

(21) Indoor & Outdoor Cable trench, Cable tray & Cable Layout for PS and STP.

Schedule for PS

(1) Cable schedules & bill of quantities.

(2) Electrical Load and Power consumption schedule.

(3) Protection relay setting schedule.

(4) Junction box schedule

Schedules for STP

(1) Cable schedules & bill of quantities.

(2) Electrical Load and Power consumption schedule.

(3) Protection relay setting schedule.

(4) Junction box schedule

Calculations

(1) Specific Energy Consumption Calculations.

(2) Bus bar sizing calculation for 11 KV Switchgears, 415 V Switchgears, 3.3kV Switchgears etc.

(3) Co-ordinated protection study as per IS 13234.

(4) Fault level and Voltage Dip Calculations as per IS 13234.

(5) Harmonic Analysis study for VFDs.

(6) Sizing of Capacitor banks.

(7) Transformer and DG Sizing Calculation

(8) Sizing Calculation for Battery and Battery Charger.

(9) Non-Segregated Bus Duct.

(a) Sizing of the bus bars vis-à-vis thermal capability to withstand rated

Continuous current and one second short time current.

(b) Spacing of the insulators vis-à-vis mechanical strength to withstand forces due to momentary short circuit current.

(c) Heat loss and temperature rise calculations for conductor and enclosure. All formulae and other information from which the heat losses have been derived shall be enlisted.

(10) HT and LT Cable sizing.

(11) Earthing sizing calculation.

(12) Room wise Lighting Calculation as per Lux level given in the specification.

(13) Outdoor Lighting Calculation.

(14) Building Lightening Protection and Earthing Sizing Calculation as per the latest standards.

Layouts

(1) Electrical Equipment Layout along with Trench details.

(2) Cable Route Layout along with tray and support details

(3) Earthing Layout

(4) Lighting Layout (Indoor as well as outdoor)

(5) Lightning Protection layout

(g) Instrumentation and Control & Automation requirements

(1) Process & Instrumentation Diagram (P&ID)

(2) System Integrator credentials for complete MIS system scope of works

(3) Implementation documentation for MIS scope of works

(4) Instrument List

(5) System Integrator credentials for complete Instrumentation scope of works

(6) Instrumentation Functional design specifications (FDS)

(7) System Integrator credentials for complete Control & Automation scope of works

(8) Control & Automation Functional design specifications (FDS)

(9) System Integrator credentials for complete lab equipment scope of works

(10) FAT procedure

(11) SAT procedure

(12) All other documentation as required under General & Particular Instrumentation requirements.

(h) Mechanical Building Services

Drawings:

- Single line schematics for waste water system and drainage systems;
- General arrangement drawings showing the location of each mechanical building service plant item;
- General arrangement of ventilation systems;
- Fixing details.

Schedule:

- Plant data sheets with Equipment GA dimensional drawing, Foundation detail, Calculation and Manufacturer's Quality Assurance Plan.
- Pipeline schedules.
- Valve schedules.

Calculations for:

- System & Equipment sizing.

The Engineer reserves the right to ask for additional Equipment/system information apart from the above to ascertain good system design and proper selection of Equipment.

3.18.6 As-Built Drawings

These drawings shall be compiled by the Contractor and shall constitute a permanent record of the Works as executed. These shall include all such drawings, schedules, documentation and calculations as necessary for a complete understanding of the Works design, operation and maintenance.

The As-Built Drawings shall consist of the fully up-dated versions of the approved Construction Documents incorporating any additional information which will assist the Employer in operating, maintaining and if necessary, modifying or extending the Works at a later date. These drawings should extend and supplement the information given in the Operating and Maintenance Manuals.

A3 and smaller sized As-Built Drawings shall be provided on durable paper for reproduction by photocopier. As-Built Drawings larger than A3 sized shall be provided as a paper copy and also produced in the form of black lines on a durable translucent film from which further paper prints can be taken by others as required. In addition, drawings shall be provided as an AutoCAD (latest revision) software copy in editable form in Hard disc of 2 TMB.

Text shall be provided in an industry standard word processing, spreadsheet or database format as appropriate (Editable copy).

3.19 Operating and Maintenance Manuals

3.19.1 General

The Contractor shall compile operating, maintenance and overhauling instructions for the whole of the Plant.

The instructions shall consist of one volume of:

(a) General descriptive text (including drawings for illustration) of the Works described section by section.

(b) Complete operational instructions for the sewage treatment plant. This shall be termed the Operators Manual. It shall be aimed at the operational staff and shall be written in clear unambiguous text complete with drawings which necessary for clarification of any issues. The manual shall comprehensively detail what to do on a day-to-day basis and also what to do in the event of faults develop. It shall in addition provide a complete list of the process maintenance tasks the operator should carry out including the intervals between these tasks.

(c) Essential instructions for mechanical and electrical maintenance of the Treatment Plant. These instructions shall be short and concise and set out in a consolidated schedule the inspection, lubrication, cleaning and any other type of servicing operations required. The Contractor shall prepare typical maintenance log sheets that the Employer can subsequently use for daily, weekly, monthly or other periodic maintenance and shall form record sheets of plant maintenance operations.

(d) Instructions for use of skilled maintenance personnel in fault location, carrying out routine replacements, withdrawing, dismantling, overhauling, re-assembling and testing the various items of Treatment Plant.

(e) Manufacturer's Technical Documentation subdivided into categories for:

- Civil.
- Process.
- Measurement against Inflow load fluctuations.
- Deterioration of treated water due to bulking.
- Other trouble shooting.
- Managing Index for process operations.
- Electrical.
- Electrical building services.
- Mechanical building services.
- Instrumentation and control.

(f) Civil As-Built Drawings.

(g) Comprising the FDS and PLC code.

(h) Electrical As-Built Drawings: The electrical drawings shall be complete sets including all information necessary for maintenance and spares replacement.

(i) Control and instrumentation As-Built Drawings: The drawings shall be complete sets including all information necessary for maintenance and spares replacement.

(j) Mechanical As-Built Drawings: The mechanical drawings shall be complete sets including all information necessary for maintenance and spares replacement.

(k) Electrical and mechanical building services As-Built Drawings: The drawings shall be complete sets including all information necessary for maintenance and spares replacement.

(l) FAT records for the Treatment Plants and Works.

(m) SAT records for the Treatment Plants and Works.

Each volume shall be subdivided (relating to areas of plant) into sub sections or sub-volumes in order to ease the location of plant details. Each volume or sub volume shall be provided with a comprehensive index for the volume or sub-volume concerned and the O & M manual as a whole.

Each volume shall be enclosed within A4 and A3 ring binders having tough grease resistant covers suitable for use on site and designed to permit the easy removal and insertion of the contents. The front cover and spine of each volume shall show details of the project, Employer, Engineer and a volume title.

Text shall generally be enclosed in A4 ring binders, A3 drawings shall be enclosed within A3 ring binders except where they accompany A4 text in which case they shall be folded. A1 drawings shall

generally be folded and enclosed in A4 box files. Where A1 drawings accompany text they shall be folded and enclosed in an A4 plastic wallet, one wallet per drawing.

3.20 Submission of Documents and Drawings

The Contractor shall supply to the Engineer 5 (five) copies each (Hard copy & Soft copy) of the drawings and design calculations for the process and sizing of all components of the System including architectural, structural, mechanical, electrical and instrumentation equipment, supported by flow diagrams and general arrangement drawings for approval. It may be noted that soft copies of the drawings will be provided and contractor shall supply drawings as detailed above.

The contractor shall design & implement the online MIS system as required in the bid requirements for on Line project monitoring tool and online document management system. The entire sequence of document submission shall be designed and implemented in the MIS System for online document submission for review and approval and project tracking of review and approval process.

The Engineer may require the Contractor to submit for approval additional drawings if they are necessary to enable him to satisfy himself that the items are well designed, that they comply with the Employer's Requirements and that they are suitable for their intended purpose. These drawings shall form the agreed basis for the execution of the Works. If an approved drawing is revised, revised copies shall be submitted for approval as above and no such revised drawing shall be used for the purposes of the Contract until it has been approved in place of the earlier issue of the drawing.

The Employer shall arrange to send observations if necessary within *28,* (Twenty-Eight) working days of submission of the design and drawings for modifications to the Contractor. The Contractor shall incorporate all necessary comments of the Engineer in the above design and drawings, if any, and shall re-submit further 5 (five) copies each (Hard copy & Soft copy) of the revised designs and drawings within 10 (ten) days for final approval of the Engineer. The Contractor shall thereafter submit 8 (eight) copies each of the approved designs and 8 (eight) copies each of the approved drawings together with one copy each of the reproducible tracings. The Engineer will return 1 (one) approved copies to the Contractor and retain 7 (seven) for the Engineer's office and field use.

If the submissions require more than one round of revision on account of incomplete compliance from Contractor, the delay will be on account of the Contractor. If new observations are given by the Engineer, the Contractor will be entitled to take an additional 10 (ten) days period for compliance.

The Engineer will signify his approval or disapproval of the Preliminary Phase Drawings / Construction Documents within 21 (twenty-one) working days of each submission.

The above time line provisions/considerations for the Engineering (Design-Drawing Documents) review by the engineer are the minimum requirements and forms a guidance only whereas the actual time period required for review is subject to the quantity (including quality) of submissions.

Also document submissions shall be in a progressive manner and in the detailed /required sequence /priority including the Basic Engineering Documents and also all submissions shall be in relation to the /correlated with the prioritized construction activities i.e., to say, all Engineering (Design Drawing Document) to correlate with the construction activities /priorities including the related orderly/sequential equipment's/ procurement requirements and no pre-mature/parallel/advance/non-sequential document submittals shall be allowed/entertained/accepted. All subsequent documents shall be submitted/accepted only upon clearance of the preceding related documents (for Instance-Investigation-Process Design-Plant Layout-Hydraulics-P&IDs-Mechanical GA-Civil GA-Structural Designs etc).

It shall be the responsibility of the contractor to obtain timely clearances/approvals for all the design drawings and related documents.

The design review meetings shall be attended by the Contractor's representative and Senior Design Engineers from Contractor whose curriculum Vitae (CV) submitted and accepted by Engineer as per Technical Bid Evaluation.

The structural designs shall be submitted along with STAAD files (input and output).

The Construction Documents are certified Drawings submitted by the Contractor to the Employer or Engineer during the course of the Contract for approval. Construction Documents shall be submitted in accordance with the timetable set down in the Work Programme.

Approval of drawings by the Engineer shall not be held to relieve the Contractor of his responsibilities under the Contract.

The construction drawings shall be submitted in A3/A1 sized drawing papers and to readable scale.

The Engineer will not permit construction to start on a part or section of the Works unless Construction Documents for that part or section have been approved.

Draft copies of the O & M Manuals shall be submitted to the Engineer for his approval at least 56 (fifty-six) calendar days prior to the commencement of Tests on Completion.

The Engineer will signify his approval or disapproval of the O & M Manuals within 21 (twenty-one) working days of submission.

Draft As-Built Drawings shall be submitted 56 calendar days prior to the commencement of Tests on Completion.

The Engineer will signify his approval or disapproval of the As-Built Drawings within 21 (twenty-one) working days of submission.

The Final As-Built Drawings shall be submitted prior to the issue of any Taking Over Certificate.

To remove doubt the submission dates referred to above shall be the dates on which the drawings and documents are received by the Engineer.

The B code & A code drawings with comment sheets in soft copy shall be submitted in Hard disc of 2 TB capacity. Similarly approved As Built Drawings and O&M manuals shall also be submitted in Hard Disc of 2 TB capacity

3.21 Notice of Operations

The Contractor shall give full and complete written notice of all important operations to the Engineer sufficiently in advance to enable the Engineer to make such arrangements as the Engineer may consider necessary for inspection and for any other purpose. The Contractor shall not start any important operation without the written approval of the Engineer.

3.22 Protection of Existing Installations

The Contractor shall apply to the Engineer in writing at least 28 days before starting any work that involves interference with existing structures, equipment, etc. The Contractor shall not execute such work until he has received permission to proceed, in writing from the Engineer.

The Contractor shall ensure that no earth, debris or rock is deposited on public or private roads or rights of way as a result of the Works and all vehicles leaving the Site shall be cleaned accordingly.

3.23 Protection of Existing Public and Private Services

The Contractor shall notify all public authorities, utility companies and private owners of proposed works that will affect them not less than two weeks before commencing the works.

The Contractor shall adequately protect, uphold, maintain and prevent damage to all services and shall not interfere with their operation without the prior consent of the public authorities, utility companies, private owners, or the Engineer as appropriate.

If any damage to services results from the execution of the Works, the Contractor shall immediately:

(a) Notify the Engineer and appropriate public authority, utility company or private owner.

(b) Make arrangements for the damage to be made good without delay to the satisfaction of the public authorities, utility company or private owner as appropriate. The Contractor shall be liable for all costs for making good such damage.

The Engineer may issue instructions or make other such arrangements as he deems necessary, to repair rapidly any essential services damaged during the execution of the Contract. Such arrangements shall not affect any liability to pay for making good the damage.

3.24 Reinstatement and Compensation for Damage to Persons or Property

The Contractor shall reinstate all properties whether public or private which are damaged in consequence of the construction and maintenance of the Works to a condition as specified and at least equal to that obtaining before his first entry on them.

If in the opinion of the Engineer the Contractor shall have failed to take reasonable and prompt action to discharge his obligations in the matter of reinstatement, the Engineer will inform the Contractor in writing of his opinion, in which circumstances the Employer reserves the right to employ others to do the necessary work of reinstatement and to deduct the cost thereof as certified by the Engineer from any money due or which shall become due from the Employer to the Contractor.

The Contractor shall refer to the Employer without delay all claims, which may be considered to fall within the exceptions listed in the Conditions of Contract.

3.25 Packing and Protection

Before any Plant is despatched from a manufacturer's factory it shall be adequately protected and packed to ensure that it will arrive on the Site in an undamaged condition. The methods employed for protection and packing must be suitable for withstanding the conditions which may be experienced during shipment, delivery to the Site and prolonged periods of storage in the open, whether the items are shipped in packing cases, crates or only partially protected according to their nature.

Bright parts and bearing surfaces shall be protected from corrosion by applying a rust preventive lacquer, high melting point grease or similar temporary protection. A sufficient quantity of solvent shall be supplied with the plant to enable this coating to be removed on the Site.

All machined flanges and other mating surfaces shall be protected by means of wood templates. The bolts for securing these templates shall not be reused in the final installation.

No one crate or package shall contain items of Plant intended for incorporation in more than one part of the Works.

All items of Plant shall be clearly marked for identification against the packing list, which shall be placed in a waterproof envelope inside every packing case or crate.

Every packing case and crate shall be indelibly marked to show its weight, serial number, top and bottom, shipping marks and handling instructions or sling marks.

Electrical Plant shall be enclosed in sealed airtight packages with dehydrating material, before being placed in packing cases on shock-absorbent material and secured by means of battens.

3.26 Quality Assurance

3.26.1 Policy

In accordance with Clause 30.3.2 of the Particular Conditions of Contract the Contractor shall apply the formal requirements of Quality Assurance to the design, supply, construction and maintenance of the

Works. This shall be achieved through the implementation of a Quality System compliant with the requirements of BS 5750 or an equivalent International Standard.

Positive commitment to Quality Assurance shall be expressed in a formal policy statement given in the Contractor's Quality Manual

3.26.1 Objectives

It shall be the stated aim of the Contractor to achieve and demonstrate the achievement of quality as expressed by due care and diligence of the design, supply, construction and maintenance of the Works as defined by the Employer's Requirements.

The criteria to define due care and diligence' shall be explained in the Contractor's Quality Plan and shall embody all of the design, supply, construction and maintenance requirements of the Works.

3.26.2 Quality System

The Quality System shall be fully integrated for all of the Works.

This system will be defined by the organisational structure, responsibilities, activities, resources, and events that together demonstrate the capability of the Contractor to meet the stated quality requirements.

The Contractor shall ensure that all Sub-Contractors and sub-consultants establish quality systems and shall supply to the Employer such evidence as is necessary to demonstrate the effective implementation of a quality system in each sub-contractor or sub-consultant organisation.

The Quality System of the Contractor and of his Sub-Contractor and sub-consultants will be subject to periodic audits undertaken by the Engineer. The Engineer will give two weeks' notice of such audits that will involve a full assessment of the performance and efficiency of the Quality System and will include review of the feedback and records derived from the Contractor's monitoring and internal reviews.

On a day-to-day basis the Contractor shall afford reasonable availability of staff and documentation for the Engineer to assess the implementation of the Quality System. The Contractor shall ensure that all relevant personnel and documentation are available for such audits.

3.26.3 Quality Plan

The implementation of the Quality System shall be through the establishment of a comprehensive Quality Plan issued to and approved by the Engineer.

The documented procedures shall include but not be limited to:

- Management Procedures.
- Design.
- Supply/Procurement.
- Construction.

- Putting to work/Commissioning/Reliability Trial/Performance Test witnessing the test and review.
- Operator Training and Maintenance.
- Interface Control.
- Quality Performance, Monitoring and Review.

There shall be procedures to control transmission of information across all interfaces both internally (that is, within the Contractor's Quality System) and externally. Those of the latter shall include all Statutory Bodies, Authorities and the Engineer.

Formal assessment of any non-compliance with the Quality Plan shall be achieved through periodic reviews undertaken by a team appointed by the Contractor. All deficiencies shall be recorded and appropriate corrective measures shall be assessed, within an appropriate timescale, through subsequent formal reviews undertaken by the Contractor.

3.26.4 Quality Feedback

The system shall include for the reporting back, recording and incorporation into the system of deficiencies and remedial measures to correct them noted during the control of the project.

3.27 Environmental Protection

The Contractor shall minimize, as far as is practically possible, the effects of all his and his Subcontractor's activities upon the environment and shall implement and monitor measures to prevent:

(a) Contamination of surfaces, ground, groundwater, surface water and rivers.
(b) Emissions to air, including smells, gases, smoke and dust.
(c) Unsanitary or unsafe storage or discharge to drain, sewer and surface waters.
(d) Unsanitary or unsafe storage or discharge of solid wastes.
(e) Noise.
(f) Visual intrusion and
(g) Excessive energy and water consumption.

These requirements shall be met through the constant and careful attention of the Contractor's management of all Site and off-site activities, and by instruction to all staff and labour in these matters.

The Contractor shall appoint an Environmental Control Manager for the Works, who shall be responsible for preparing an Environmental Management Plan and ensuring its implementation by the Contractor after obtaining approval of the Engineer.

Implementation shall include for monitoring and reporting on the results of the above measures. Monitoring reports shall be in writing and submitted on a monthly basis as part of the monthly report referred to above. The report shall include a listing and summary of daily monitoring results on all aspects listed above.

All potentially affected areas of the Site, other areas used for or affected by the works and all adjacent or affected waterways shall be monitored and, where instructed by the Engineer, tested.

The Environmental Management Plan (EMP) shall identify the potential environmental impacts from the various construction and operations and maintenance activities to be undertaken in the Contract and set out in detail the approach he will adopt in mitigating these environmental impacts to ensure that the residual impacts are minor and confined to a short period.

The EMP shall consider but not be limited to the following:

- The methods of materials delivery, storage, usage and disposal; equipment usage; and site activities to ensure they have minimal impact on the environment.
- Only environmentally safe products and practices shall be adopted in performing his works and
- The Contractor shall comply with all of the statutes regarding environmental effects.

The EMP shall provide separate descriptions of its proposals for minimizing any adverse environmental impacts/effects during the construction phase and the subsequent operations and maintenance phase.

The EMP shall be provided in draft form within 28 days from the Notice to Commence, and shall be updated from time to time by the Contractor as agreed or required by the Engineer to ensure the objectives of environmental protection are fully met.

3.28 Safety.

The Contractor shall prepare a Safety Plan and submit the same to the Engineer for approval within 28 days of receiving the Notice to Commence.

The Safety Plan shall be followed at all times by the Contractor and shall contain adequate control measures, in accordance with the relevant protection of property and local laws and regulations as well as internationally accepted good practice, for the prevention of accidents, fires and public nuisance.

The Safety Plan shall be implemented properly and diligently throughout the execution of the Works and during the operations and maintenance period.

The Contractor’s Safety Plan shall make safety provision for, among other things:

(a) Deep excavations and collapsing sides in trench excavations.
(b) Scaffolds and overhead working.
(c) Working in confined spaces.
(d) Working in water.
(e) Contractor's Equipment, especially cranes, heavy vehicles, etc.
(f) Hand held power tools.
(g) Electrical equipment, power connection.
(h) Hazardous chemicals, gases and fuels.
(i) The use of protective clothing and
(j) The provision of first aid facilities.

- On-Site Patrol
    - The Safety Manager patrols everyday (preparation of report & announcement in morning meeting)
    - Surprise inspection by Engineer
    - Regular safety exercise
    - Morning meeting every day
- The Contractor shall at all times in the conduct of his work and that of his Subcontractors adhere to the established rules and regulations concerning all safety matters at Site such as the recommendations contained in the "Manual of Accident Prevention in Construction", published by the Associated General Contractors of America, Inc., or other Internationally recognized recommendations to the extent that such provisions do not conflict with the applicable laws. This is especially important wherever it is necessary to enable the free passage of the public through the Site.

The Safety Plan shall be developed to ensure zero fatal accidents and zero hazardous incidents/occurrences in all construction works. The Safety Plan shall include descriptions of the company's standard policies and procedures regarding its site organization and procedures, methods and frequency of conducting safety audits at the Site(s), record keeping and reporting, providing safety training for its personnel (including subcontractors), issue and mandatory use of safety equipment, and details of the qualifications and experience of the Bidder's proposed safety officers to be deployed at the Site(s). The Contractor shall provide separate descriptions in its Safety Plan covering the construction phase and the subsequent operations and maintenance phase.

- The Contractor shall appoint a full time Expert/ Health and Safety Engineer/Manager (Accident Prevention Officer) right from the start of the project having the required qualifications, safety certifications and experience in this field, who shall be responsible for implementing the Safety Plan. He should have the authority to issue instructions to the Contractor's personnel regarding protection measures to prevent accidents. The contractor shall submit the CV of the proposed engineer for review and approval.
- The Contractor shall provide the public, site labour and contractor staff with adequate information on all risks with respect to the construction works. If the general public,

site labour and contractor staff sustain any kind of bodily injury or death, the Contractor shall be solely responsible for providing all necessary medical care and compensation and any other requirements, as per applicable statutory requirements.

The Contractor shall ensure that his staff and labour and his Subcontractors are all fully trained in and aware of good and safe working practices.

The Contractor shall ensure that all precautions are taken to safeguard the general public and construction/operating staff from any danger.

During construction the Contractor shall erect, maintain and subsequently remove sufficient barricades, guards, lighting, sheeting, shoring, temporary sidewalks and bridges, danger signals as well as temporary covering of potential accident areas, as approved by the Employer.

All temporary and partially completed works shall be protected by way of barriers, lights, notices and the like.

All excavations and the like are to be protected by barriers at all times and adequately illuminated at night. Adequate numbers of Life buoys are to be provided near water retaining structures with depth more than 1.2m during construction and Operation & Maintenance stage.

All open excavations along pipe lines shall be protected sufficiently to keep out livestock, and ensure the safety of workmen and members of the public and be in accordance with the directives of the police and the other local regulations.

The Contractor shall be responsible for ensuring that all persons working in the vicinity of power lines are aware of the relatively large distance that high voltage electricity can "short" to earth when cranes or other large masses of steel are in the vicinity of power lines.

Where work is to be carried out in the proximity of buildings, bridges, tanks or other structures, the Contractor shall take all necessary precautions, including shoring and strutting, where necessary, to ensure the safety of the structures that are at risk.

The Contractor shall be responsible for all damages or injury which may be caused on any property by trespass by the Contractor's or his Subcontractor's employees in the course of their employment, whether the said trespass was committed with or without the consent or knowledge of the Contractor.

Warning and diversion signs concerning roadwork shall be suitably placed to give motorists ample warning. During the movement of heavy vehicles across roads or onto roads, men, bearing red flags, shall be in attendance to warn other road users and to generally control traffic in a safe manner.

The Safety Plan shall also consider requirements for warning and protection for other risks including overhead and underground cables, pipes or obstructions, or voids, openings, pits and trenches. The Contractor shall ensure that all appropriate measures are implemented.

1. Suitable scaffolds should be provided for workmen for all works that cannot safely be done from the ground, or from solid construction except such short period work as can be done safely from ladders. When a ladder is used an extra mazdoor shall be engaged for holding the ladder and if the ladder is used for carrying materials as well suitable footholds and hand-hold

shall be provided on the ladder and the ladder shall be given an inclination not steeper than ¼ to 1 (¼ horizontal and 1 vertical).

2. Scaffolding of staging more than 3.6 m above the ground or floor, swung or suspended from an overhead support or erected with stationary support shall have a guard rail properly attached or bolted, braced and otherwise secured at least 90 cm. high above the floor, or platform of such scaffolding or staging and extending along the entire length of the outside and ends thereof with only such opening as may be necessary for the delivery of materials. Such scaffolding or staging shall be so fastened as to prevent it from swaying from the building or structure.
3. Working platforms, gangways and stairways should be so constructed that they should not sag unduly or unequally, and if the height of the platform or the gangway or the stairway is more than 3.6 m above ground level or floor level, they should be closely boarded; should have adequate width and should be suitably fastened as described in (2) above.
4. Every opening in the floor of a building or in a working platform shall be provided with suitable means to prevent the fall of person or materials by providing suitable fencing or railing whose minimum height shall be 90 cm.
5. Safe means of access shall be provided to all working platforms and other working places. Every ladder shall be securely fixed. No portable single ladder shall be over 9 m. in length while the width between side rails in rung ladder shall in no case be less than 29 cm. for ladder up to and including 3 m. in length. For longer ladders this width should be increased at least 6 mm for each additional 30 cm. of length. Uniform step spacing of not more than 30 cm shall be kept. Adequate precautions shall be taken to prevent danger from electrical equipment. No materials on any of the sites or work shall be so stacked or placed as to cause danger or inconvenience to any person or the public. The contractor shall provide all necessary fencing and lights to protect the public from accident. The Contractor shall be bound to bear the expenses of defence of every suit, action or other proceedings at law that may be brought by any person for injury sustained owing to neglect of the above precautions and to pay any damages and cost which may be awarded in any such suit, action or proceedings to any such person.
6. Excavation and Trenching - All trenches 1.2 m. or more in depth, shall at all times be supplied with at least one ladder for each 30 m. in length or fraction thereof. Ladder shall extend from bottom of the trench to at least 90 cm. above the surface of the ground. The sides of the trenches which are 1.5 m. or more in depth shall be stepped back to give suitable slope or securely held by timber bracing, so as to avoid the danger of sides collapsing. The excavated materials shall not be placed within 1.5 m. of the edges of the trench or half of the depth of the trench whichever is more. Cutting shall be done from top to bottom. Under no circumstances undermining or undercutting shall be done.
7. Demolition - Before any demolition work is commenced and also during the progress of the Work,

    i) All roads and open areas adjacent to the work site shall either be closed or suitably protected.

ii) No electric cable or apparatus which is liable to be a source of danger or cable or apparatus used by the operator shall remain electrically charged.

iii) All practical steps shall be taken to prevent danger to persons employed from risk of fire or explosion or flooding. No floor, roof or other part of the building shall be so overloaded with debris or materials as to render it unsafe.

8. All necessary personal safety equipment as considered adequate by the Employer should be kept available for the use of the person employed on the site and maintained in a condition suitable for immediate use, and the contractor should take adequate steps to ensure proper use of equipment by those concerned.

The following safety equipment shall invariably be provided.

i) Workers employed on mixing asphalt materials, cement and lime mortars shall be provided with protective footwear and protective goggles.

ii) Those engaged in white washing and mixing or stacking of cement bags or any material which is injurious to the eyes shall be provided with protective goggles and nose masks.

iii) Those engaged in welding works shall be-provided with welder's protective eye Shields, nose mask & gloves.

iv) Stone breaker shall be provided with protective goggles and protective clothing and seated at sufficiently safe intervals.

v) When workers are employed in sewers and manholes, which are in active use, the contractors shall ensure that the manhole covers are opened and ventilated at least for an hour before the workers are allowed to get into the manholes, and the manholes so opened shall be cordoned off with suitable railing and provided with warning signals or boards to prevent accident to the public, in addition, the contractor shall ensure that the following safety measures are adhered to:

a) Entry for workers into the line shall not be allowed except under supervision of the Engineer.

b) At least 5 to 6 manholes upstream and downstream should be kept open for at least 2 to 3 hours before any man is allowed to enter into the manhole for working inside.

c) Before entry presence of Toxic gases should be tested by inserting wet lead acetate paper which changes colour in the presence of such gases and gives indication of their presence.

d) Presence of Oxygen should be verified by lowering a detector lamp into the manhole. In case, no Oxygen is found inside the sewer line, workers should be sent only with Oxygen kit and self-contained breathing apparatus (SCBA).

e) Double layer safety harness with shock absorber and rope should be provided to the workers. While working inside the manholes such rope should be handled by two men standing outside with pulley system to enable him to be pulled out during emergency conditions.

f) The area should be barricaded or cordoned off by suitable means to avoid mishaps of any kind. Proper warning signs should be displayed for the safety of the public whenever cleaning works are undertaken during night or day.

g) No smoking or open flames shall be allowed near the blocked manhole being cleaned.

h) The malba (solid waste) obtained on account of cleaning of blocked manholes and sewer lines should be immediately removed to avoid accidents on account of slippery nature of the malba.

i) Workers should not be allowed to work inside the manhole continuously. He should be given rest intermittently. The Engineer may decide the time up to which a worker may be allowed to work continuously inside the manhole.

j) Self-contained breathing apparatus (SCBA) and first aid should always be present at site for use in any emergency.

k) Air-blowers should be used for flow of fresh air through the manholes. Whenever called for portable air blowers are recommended for ventilating the manholes. The Motors for these shall be vapour proof and of totally enclosed type. Non sparking gas engines also could be used but they should be placed at least 2 meters away from the opening and on the leeward side protected from wind so that they will not be a source of friction on any inflammable gas that might be present.

l) The workers engaged for cleaning the manholes/sewers should be properly trained in "Confined Space" before allowing working in the manhole.

m) The workers shall be provided with Gumboots or non-sparking shoes, bump helmets and gloves, non-sparking tools safety lights and gas masks and portable air blowers (when necessary). They must be supplied with barrier cream for anointing the limbs before working inside the sewer lines.

n) Workmen descending a manhole shall try each ladder stop or rung careful before putting his full weight on it to guard against insecure fastening due to corrosion of the rung fixed to manhole well.

o) If a man has received a physical injury, he should be brought out of the sewer immediately and adequate medical aid should be provided to him.

p) The extent to which these precautions are to be taken depend on individual situation but the decision of the Engineer regarding the steps to be taken in this regard in an individual case will be final.

vi) Contractor shall be fully and solely responsible in the event of death of employee/workmen during the execution of the work and liable to pay adequate compensation to the dependants of employee/workmen as per law. On his/their failure, if the Board is made to pay compensation the same shall be recovered by the Board from the contractor out of the amount due to the contractor or by appropriate legal action. If death of any employee occurs during execution of work due to negligence of contractor, the contract may be liable for termination. The Board will be entitled to claim exemplary damages from the contractor in case of death of any

workman/employees of the contractor in any of the BWSSB works as it damage the reputation of the Board.

vii) The Contractor shall not employ men and women below the age of 18 years on the work of painting with products containing lead in any form. Wherever men above the age of 18 are employed on the work of lead painting, the following precaution should be taken:

a) No paint containing lead or lead products shall be used except in the form of paste or readymade paint.

b) Suitable face masks should be supplied for use by the workers when paint is applied in the form of spray or a surface having lead paint is dry rubbed and scraped.

c) Overalls shall be supplied by the contractors to the workmen and adequate facilities shall be provided to enable the working painters to wash during and on the cessation of work

d) White lead, sulphate of lead or product containing these pigment, shall not be used in painting operation except in the form of pastes or paint ready for use.

i) Measures shall be taken, wherever required in order to prevent danger arising from the application of paint in the form of spray.

ii) Measures shall be taken, wherever practicable, to prevent danger arising out of from dust caused by dry rubbing down and scraping.

iii) Adequate facilities shall be provided to enable working painters to wash during and on cessation of work.

iv) Overalls shall be worn by working painters during the whole of working period.

v) Suitable arrangement shall be made to prevent clothing put off during working hours being spoiled by painting materials.

vi) Cases of lead poisoning and suspected lead poisoning shall be notified and shall be subsequently verified by medical man appointed by competent authority of BWSSB.

vii) BWSSB may require, when necessary medical examination of workers including measuring blood lead levels.

viii) Instructions with regard to special hygienic precautions to be taken in the painting.

9. When the work is done near any place where there is risk of drowning, all necessary equipment should be provided and kept ready for use and all necessary steps taken for prompt rescue of any person in danger and adequate provision, should be made for prompt first aid treatment of all injuries likely to be obtained during the work.

10. Use of hoisting machines and tackle including their attachments, anchorage and supports shall conform to the following standards or conditions:

i. These shall be of good mechanical construction, sound materials and adequate strength and free from patent defects and shall be kept repaired and in good working order.

ii. Every rope used in hoisting or lowering materials or as a means of suspension shall be of durable quality and adequate strength, and free from patent detects.

iii. Every crane driver or hoisting appliance operator shall be properly qualified and no person under the age of 21 years should be in charge of any hoisting machine including any scaffolding winch or give signals to operator.

iv. In case of every hoisting machine and of every chain ring hook, shackle swivel and pulley block used in hoisting or as means of suspension, the safe working load shall be ascertained by adequate means. Every hoisting machine referred to above shall be plainly marked with the safe working load. In case of a hoisting machine having a variable safe working load each safe working load and the condition under which it is applicable shall be clearly indicated. No part of any machine or any gear referred to above in this paragraph shall be loaded beyond the safe working load except for the purpose of testing.

v. The Contractors shall notify the safe working load of the machine to the Employer-in-charge whenever he brings any machinery to site of work and get it verified by the Electrical Employer concerned.

11. Motors, gearing, transmission, electric wiring and other dangerous parts of hoisting appliances should be provided with efficient safeguards. Hoisting appliances should be provided with such means as will reduce to the minimum risk of accidental descent of the load. Adequate precautions should be taken to reduce to the minimum risk of any part of a suspended load becoming accidentally displaced. When workers are employed on electrical installations, which are already energized, insulating mats, wearing apparel, such as. Gloves, sleeves and boots as may be necessary should be provided. The worker should not wear any rings, watches and carry keys or other materials, which are good conductors of electricity.

    All scaffolds, ladders and other safety devices mentioned or described herein shall be maintained in safe condition and no scaffold, ladder or equipment shall be altered or removed while it is in use. Adequate washing facilities should be provided at or near places of work.

12. These safety provisions should be brought to the notice of all concerned by display on a notice board at a prominent place at work spot. The person responsible for compliance of the safety code shall be named therein by the contractor.

13. To ensure effective enforcement of the rules and regulations relating to safety precautions the arrangements made by the contractor shall be open to inspection by the Labour Officer or Employer-in-Charge of the department or their representatives.

14. Notwithstanding the above Clauses from (1) to (13) there is nothing in these to exempt the contractor from the operations of any other Act or Rule in force In the Republic of India.

3.28.2 Additional Safety Guidelines

Following guideline /instructions should be adhered to in true spirit:

1. The door may be fixed at the entry of the stair case and the open portion of the stair case of sump

well should be protected by grill up to the height of 7 feet and compartments of the sump well should be covered with jallis/grating or should be barricaded property.

2. An inspection register should be placed at the sewage pump house in which all the inspecting officers may record their observations. No unauthorized entry should be allowed.
3. Caution board showing the restricted entry area and name of components and moving mechanical part should be displayed.
4. The entry to all BWSSB infrastructures should be restricted to the person /persons authorized by BWSSB or having I.D cards issued by the chief security officer.
5. Just after entering the premises do's and don'ts should be displayed at prominent places in all three languages.
6. Even authorized visitors should be provided proper uniform /visitor badges helmet and relevant safety gear and given instruction before showing such infrastructure.

No person below 18 years age should be allowed on the premises where chances of emission of toxic gases are extensive.

3.28.3 National Human Rights Commission (NHRC) Guidelines

NHRC issued guidelines on safety code for operation/maintenance of sewerage system has to be strictly followed during execution of work. Direction given by Hon'ble Supreme Court in the matter of National Campaign for Dignity & Right of Sewerage & Allied workers.

1. The medical examination and medical treatment will be given free of charge to sewer workers and the treatment will continue for all such workers found to be suffering from an occupational disease, ailment or accident until the workman is cured or until death.
2. The services of the sewer workers are not to be terminated, either by the respondents or the contractors engaged by them during the period of illness and they shall be treated as if on duty and will be paid their wages.
3. The respondents shall pay on the death of any worker including any contract worker, an immediate ex-gratia solatium of One lakh with liberty to recover the same from contractors, if permissible in law.
4. The respondents shall pay/insure payment of all statutory dues such as Provident Fund, Gratuity and Bonus to all the sewer workers including contract workers, as applicable in law.
5. The respondents shall provide as soon as possible modern protective equipment to all the sewer workers in consultation with the petitioner organization.
6. The respondents shall provide soap and oil to all the workmen according to the present quota but on monthly basis and not at the end of the year.
7. The respondents shall provide all workmen including contract workmen with an accident-card-cum-wage-slip.

3.28.4 Protection of Overhead and Underground Services

- The Contractor will be held responsible for any damage to known services (i.e. overhead services that are visible within the Site and underground services shown on the drawings) and he shall take all necessary measures to protect them. All work or protective measures shall be subject to approval of the Employer. In the event of a service being damaged he shall inform the Employer and the authority concerned, the Contractor shall not repair any such service unless instructed to do so.

- Contractor will map the underground utilities. Where no underground services are shown on the drawings or scheduled but the possibility of their presence can reasonably be inferred, the Contractor shall, in collaboration with the Employer, ascertain whether any such services exist within the relevant section of the Site. The Contractor shall complete such an investigation well in advance of the start of construction work in the said section and he shall submit a report in good time to enable the Employer to take necessary actions.
- In main roads and junctions, irrespective of utility services indicated in the drawing, the Contractor need to take proper care prior to commencement of Construction activities so as to ensure minimum disruption to the services. This may require even making a cross sectional trail pit to determine the exact alignments of different utilities.
- Taking care of other utility services infrastructure during the execution of the works is the responsibility of the Contractor. Nothing in the Contract should relieve the Contractor from his responsibility towards safety of other utility services infrastructure during project execution. The Contractor's Construction program should include such activities into consideration and no extra claim towards time of completion and cost in this regard shall be entertained.
- As soon as any underground service not shown on the drawings is discovered, it shall be deemed to be a known service and the Contractor will be held responsible for any subsequent damage to it.
- Where the authority concerned elects to carry out on its own account any alterations or protective measures, the Contractor shall co-operate with and allow such authority reasonable access and sufficient space and time to carry out the required work.

The Safety Plan shall include a policy statement signed by the CEO or equivalent authority of the Organization declaring that safety and loss prevention shall be given the highest practicable priority in all aspects of the Contract. The Safety Plan shall be updated as necessary to cover the activities to be undertaken for operations and maintenance.

End of Part 3